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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/792,126 | 03/04/2004 | Vittorio Accomazzi | T00249-0104-US2 | 3910 |

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| EXAMINER | |
|---|---|
| AZARIAN, SEYED H | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2625 | |

DATE MAILED: 04/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/792,126 | ACCOMAZZI, VITTORIO | |
| | Examiner | Art Unit | |
| | Seyed Azarian | 2625 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *04 March 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/20/2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

## Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-39, are rejected under 35 U.S.C. 103(a) as being unpatentable over Edwards et al (U.S. patent 5,787,889) in view of Cabral et al (U.S. patent 6,002,738).

Regarding claim 1, Edwards discloses ultrasound imaging with real time 3D image reconstruction and visualization comprising: a method for generating a 2-D image projection directly from a 3-D volume data (column15, lines 8-16, a projection of the shear forms a 2D image);

a) determining a viewing direction vector in a viewing frustum, the viewing frustum containing a plurality of viewing vectors (Fig. 8 and 6, column 3, lines 64-65, viewing plane direction);

b) determining a major axis of the viewing direction vector column 16, lines 26-38, viewing axis);

c) re-sampling a selected set of the viewing vectors in the volume data with a refined grid according to a selected image parameter, the re-sampling in a direction of said major axis (column 15, lines 38-46, the slices 54 are translated and resample as shown in Fig. 8);

d) applying a shear factorization to the re-sampled data according to the selected image parameter; and (column 15, lines 8-19, refer to factorization process);

e) applying a warp operator for rendering the factorized data for producing said 2-D image projection (column 3, lines 5-15, rendering 2D projection is displayed, also lines 24-34);

wherein the image parameter is selected so as to provide each vector of the selected set of viewing vectors with the same major axis of the direction vector (column 7, line 54 through column 8, line 5, to registering each image plane and parameters completely describe the position and orientation of the receiver's coordinate system.

However Edwards is silent about "frustum or pyramid". On the other hand Cabral teaches (column 19, lines 13-22, engine supports up to six concurrent arbitrary clipping planes in addition to the six viewing frustum clipping planes).

Therefore it would have been obvious to one having ordinary skill in the art at the time of the invention was made, to modify Edwards invention according to the teaching of Cabral because it provides graphics hardware which rendering and slicing at the same time with no performance degradation, to improve and accelerates both texture mapping and weighted accumulation.

Regarding claim 2, Edwards discloses a method, further comprising the step of determining said viewing frustum by specifying positional data of a viewing point and a central

point, said central point to be substantially centered in said 2-D projection (column 8, lines 48-65, defined as the top center of the image and center column of the image).

Regarding claim 3, Edwards discloses the method, wherein said positional data of said viewing point further includes direction of orientation data of said viewing point in said volume data (vectors (Fig. 8 and 6, column 3, lines 64-65, viewing plane direction).

Regarding claim 4, Edwards discloses the method, wherein said viewing frustum is a truncated pyramidal geometrical structure (column 15, lines 38-53, refer to slices 54 and geometric image).

Regarding claim 5, Edwards discloses the method, further comprising the step of determining boundaries of said viewing frustum by constructing boundary vectors, each of the boundary vectors including said viewing point and extending to each respective corner of said volume data wherein said viewing point is positioned external to the positions contained by said volume data (column 8, lines 26-43, refer to corner position and boundary).

Regarding claim 6, Edwards discloses the method, further comprising the step of employing geometrical information obtained from said boundary vectors for determining the image parameter used to select a resolution of said refined grid, the image parameter being a step size (column 19, lines a desired viewing angle is obtained at a desired resolution).

Regarding claim 7, Edwards discloses the method, further comprising the step of using the major component of said viewing direction vector for determining said major axis (column 9, lines 19-34, refer to major axis).

Regarding claim 8, Edwards discloses the method, further comprising the step of selecting the image parameter for determining a resolution of said refined grid, the image parameter being a step size (column 11, lines 29-36, refer to grid).

Regarding claim 9, Edwards discloses the method, wherein said step size is used for providing the plurality of viewing vectors in said viewing frustum to have the same said major axis in an object viewing space as said viewing direction vector (column 16, lines 27-39, viewing axis and rearrange the volume into a space).

Regarding claim 10, Edwards discloses the method, wherein said viewing direction vector contains a viewing point and a central point, said central point is substantially centered in said 2-D image projection (column 8, lines 48-65, defined as the top center of the image and center column of the image).

Regarding claim 11, Edwards discloses the method, wherein the plurality of viewing vectors in said viewing frustum are rendered with the same factorization matrix (column 15, lines 8-19, refer to factorization process).

Regarding claim 12, Edwards discloses the method, further comprising the step of using one copy of said volume data for applying said shear factorization (column 16, lines 24-31, refer to shear 3D).

Regarding claim 13, Edwards discloses the method, further comprising the step of accessing said volume data in a pre-defined storage order (column 15, lines 37-46, image data to be accessed in storage order).

Regarding claim 15, Edwards discloses the method, further comprising the step of accessing said memory once for every selected one of the image slices in said stack (column 15, lines 38-46, the slices 54 are translated and resample as shown in Fig. 8).

Regarding claim 16, Edwards discloses the method, further comprising the step of constructing the set of separate viewing vectors containing said viewing point and each of the separate viewing vectors extending to a respective one of a plurality of voxels contained in said viewing frustum, wherein a position of said viewing point is located within said volume data (column 7,lines 37-51, the image plane is distributed over the surrounding voxels).

Regarding claim 17, Edwards discloses the method, further comprising the step of selecting the image parameter for determining a resolution of said refined grip, the image parameter being a step size, wherein a viewing angle contained by said viewing frustum and said viewing direction vector is less than 90° (column 16, line 63 through column 17, line 9, refer to angles).

Regarding claim 18, Edwards discloses the method, further comprising the step of restricting the re-sampling step to selected ones of the set of the plurality of viewing vectors in said viewing frustum, the selected ones having a preliminary major axis different from said major axis of said viewing direction vector (column 16, line 26-43, refer to different axis).

Regarding claim 19, Edwards discloses a method, wherein the rendering of the factorized data produces a 3-D image (column 7, lines 1-10, generating 3D image).

Regarding claim 20, Edwards discloses a system for generating in substantially real-time fashion in response to input from a user a 2-D image projection directly from a 3-D volume data, the system comprising: a) a memory for storing the volume data; b) a processor for factorizing

and rendering an image data set selected from said display for displaying said image projection provided by said processor; and a refined grid used by said processor for re-sampling a selected set of the viewing vectors in said image data set (see claim 1, and column 5, lines 24-32, refer to display device).

Regarding claim 22, Edwards discloses a system, wherein said image parameter includes a viewing point and a central point, said central point is substantially centered in said 2-D image projection (column15, lines 8-16, a projection of the shear forms a 2D image);

Regarding claim 24 Edwards discloses the system, wherein said volume data is stored in said memory as a stack of 2-D image slices (column 15, lines 37-46, image data to be accessed in storage order).

Regarding claim 28 Edwards discloses the system according to claim 24, wherein said stack of 2-D image slices is obtained from an imaging system selected from the group comprising Ct, MRI, and Ultrasound (Fig. 1, column 46-48, refer to ultrasound).

Regarding claims 14, 21 and 23, recites similar limitation as claims 2, 13 and 18, are similarly analyzed.

Regarding claims 25, 26 and 30, recites similar limitation as claims 13, 1 and 20, are similarly analyzed.

Regarding claims 27, 29 and 31, recites similar limitation as claims 8 and 19, are similarly analyzed.

Regarding claims 32-34, recites similar limitation as claims 11 and 16, are similarly analyzed.

Regarding claims 35-39, recites similar limitation as claims 18, 18 and 19, are similarly analyzed.

***Other prior art cited***

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. patent (5,803,082) to Stapleton et al is cited for omnispectramammography.

U.S. patent (5,956,418) to Aiger et al is cited for method of mosaicing ultrasonic volumes for visual simulation.

U.S. patent (6,167,297) to Benaron is cited for detecting, localizing, and targeting internal sites in vivo using optical contrast agents.

U.S. patent (6,330,356) to Sundareswaran et al is cited for dynamic visual registration of a 3-d object with a graphical model.

U.S. patent (6,553,152) to Miller et al is cited for method and apparatus for image registration.

## ***Contact Information***

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Seyed Azarian whose telephone number is (571) 272-7443. The examiner can normally be reached on Monday through Thursday from 6:00 a.m. to 7:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached at (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR.
Status information about the PAIR system, see http:// pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*Seyed Azarian*
*Patent Examiner*
*Group Art Unit 2625*
April 18, 2005

Seyed azarian